

Property of
Flood Control District of MC Lib
Please return to
265 J. W. Durango
Phoenix, AZ 85009

PRE-SED BYPASS LINE

Squaw Peak WTP
Phoenix, Arizona



Prepared for

John Carrollo Engineers
3877 North 7th Street, #400
Phoenix, Arizona



THOMAS-HARTIG & ASSOCIATES, INC.

GEOTECHNICAL, MATERIALS TESTING, AND ENVIRONMENTAL CONSULTANTS

A118.946



THOMAS-HARTIG & ASSOCIATES, INC.

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Phoenix, Arizona 85014-5005

Attention: George E. Shirley, P.E.

Project: Pre-Sed Bypass Line
Squaw Peak WTP
Phoenix, Arizona

FLOOD CONTROL DISTRICT			
RECEIVED			
FEB 20 '90			
CH ENG		P & PK	
DEP		HYDR	
ADMIN		LMGT	
FINANCE		FILE	
C & O			
ENGR			
REMARKS			

14 February 1990

Project No. 90-0145

As you requested, we have gathered geotechnical data in the vicinity of the proposed bypass pipeline, located on the south side of the existing pre-sed basin at the Squaw Peak Water Treatment Plant.

Investigation: Data we gathered includes the following:

1. Visual logging at the north wall of the pre-sed basin was performed 31 January 1990, at locations A, B, and C, as shown on the attached site plan. Results are presented in the attached tabulation.
2. Borings B-1A through B-4A, and B-6 through B-9 were advanced as part of geotechnical investigations performed by Thomas-Hartig & Associates (THA) for John Carrollo Engineers in 1989, Project No. 89-0872 and 89-0326, respectively. Boring logs are attached.
3. Seismic refraction surveys were performed at locations S9 and S10 as as part of THA Project No. 89-0326. Results are attached.

Soil and Rock Conditions: As illustrated on the attached boring logs and the attached visual descriptions of the north wall of the pre-sed basin, the soil and bedrock stratigraphy varies somewhat at the boring and visual log locations. In general, a few inches to about six feet of soil cover overlies a deposit of cemented breccia fanglomerate. The surface soils consisted primarily of clayey sands and gravels. The underlying breccia fanglomerate consisted of angular gravel and cobble-sized rock clasts in a matrix of caliche-cemented angular sand,

with the degree of cementation generally varying from moderate to heavy. Zones on concrete-like consistency, with refusal to auger penetration were encountered. The depth of soil cover overlying the breccia fanglomerate varies from a maximum of about six feet at the west end of the bypass line (visual log location A), gradually decreasing toward the east end of the bypass line, where breccia fanglomerate is exposed at the surface with no soil cover present.

Excavation Conditions: The test drilling and seismic refraction surveys at the site were performed primarily for design purposes. It is not possible to accurately correlate drilling results with the ease or difficulty of digging for various types and sizes of excavation equipment. However, the seismic velocities of the various strata as determined by the seismic refraction surveys provide an indirect, approximate indication of excavatability based on correlations published by excavation equipment manufacturers. At seismic refraction locations, a preliminary estimate of excavatability is presented based on the following approximate correlation:

<u>Seismic Velocity</u>	<u>Estimated Ease of Excavation</u>
0 - 2759 fps	Easy: easy to rip
2750 - 5000 fps	Moderate: difficult ripping
5000+ fps	Difficult: blasting probably necessary

Based on the above approximate correlation, the ease of excavation can be estimated where the pre-sed line crosses Seismic Refraction Line S9:

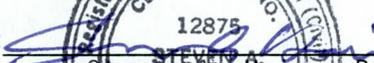
Excavation of the upper 13 feet \pm (4000 - 5000 fps seismic velocity) will entail moderate to difficult ripping. Underlying materials below about 13 \pm (8000 fps seismic velocity) will be difficult, and blasting may be necessary.

A more detailed discussion of the results and interpretation of the seismic survey data is presented in Appendix C of a previous THA report, THA Project No. 89-0326. More accurate information regarding excavatability could be evaluated by contractors or other interested parties from test excavations using the intended equipment. Excavations should be braced or sloped as required to provide personnel safety and satisfy local safety code regulations.

Please call if you have any questions or if we may be of further assistance.

Respectfully submitted,

THOMAS-HARTIG & ASSOCIATES, INC.

By: 
Steven A. Haire, P.E.
/ag
Copies to: Addressee (5)



Reviewed by: 
Kenneth L. Ricker, P.E.



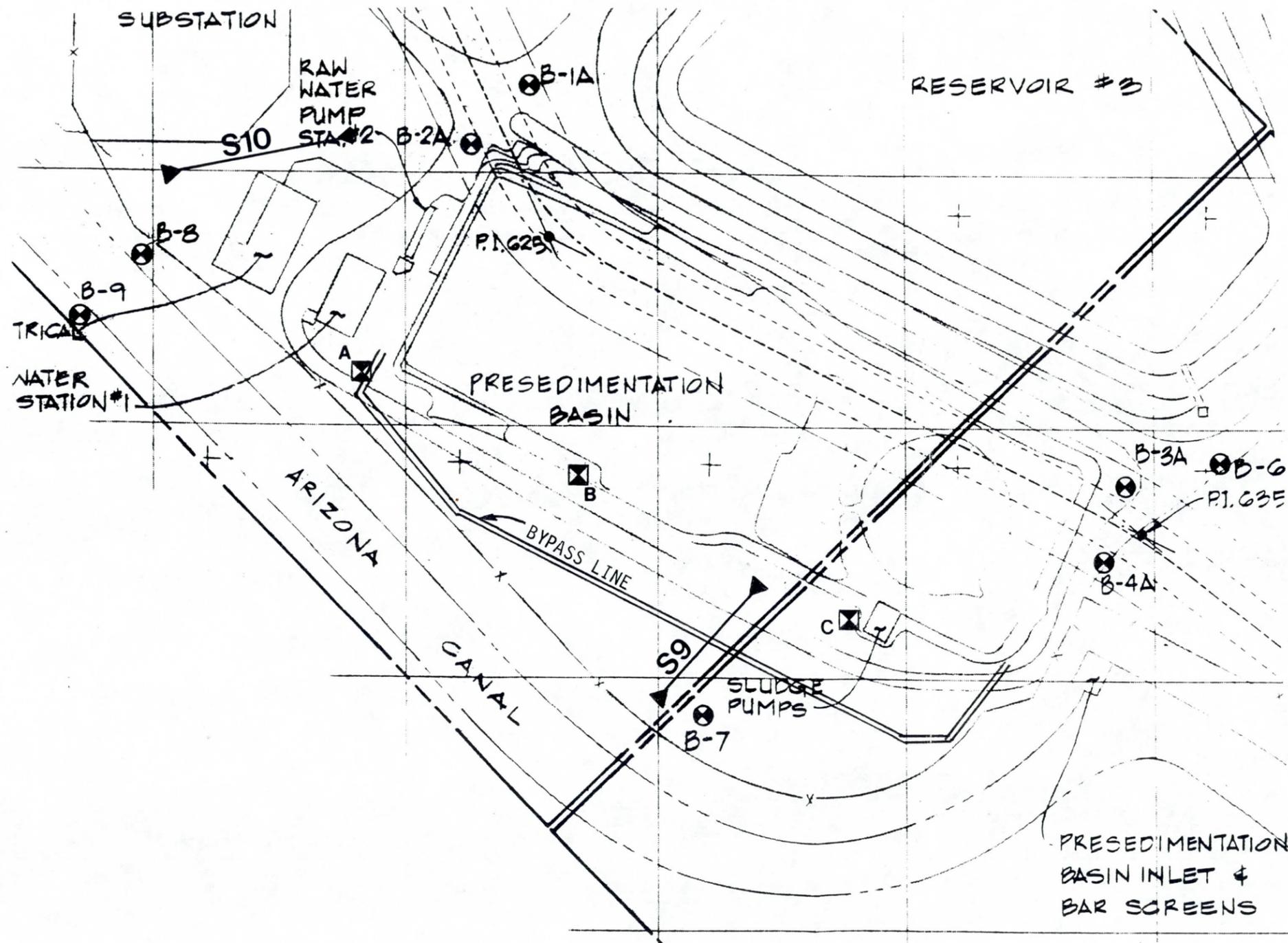
FIELD RESULTS

Site Plan

Visual Logs

Boring Logs

Seismic Survey Data



Scale
1"=100'

FLOJO COUNTY DISTRICT	
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CH. ENG.	P & PM
DEF.	HYDR.
ADMIN.	LMGT.
FINANCE	FILE
C & O	
ENGR.	
REMARKS	

☒ Visual log location

⊗ Test boring location

↔ Seismic refraction line location

VISUAL LOGS AT THE PRE-SED BASIN - 31 JANUARY 1990

<u>Visual Log Location Number</u>	<u>Exposure</u>	<u>Approximate Elevation/Material</u>
A	N. wall of Pre-sed Pump Plant Basin	1244-1238 ft.: Clayey Sand and Gravel 1238-1236 ft : Breccia Fanglomerate 1236 ft : Water surface
B	N. wall of Pre-sed Basin	1244-1240.5 ft.: Clayey Sand and Gravel 1240.5-1236 ft : Breccia Fanglomerate 1236 ft : Water surface
C	Exposed level ground south of pre-Sed Basin near Sludge Pumps	1249 ft.: Breccia Fanglomerate at ground surface

LEGEND

SOIL CLASSIFICATION

COARSE-GRAINED SOIL

More than 50% larger than 200 sieve size

SYMBOL	LETTER	DESCRIPTION	MAJOR DIVISIONS
	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - #200 FINES	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size
	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - #200 FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% - #200 FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% - #200 FINES	
	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - #200 FINES	SANDS More than half of coarse fraction is smaller than No. 4 sieve size
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - #200 FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES MORE THAN 12% - #200 FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES MORE THAN 12% - #200 FINES	

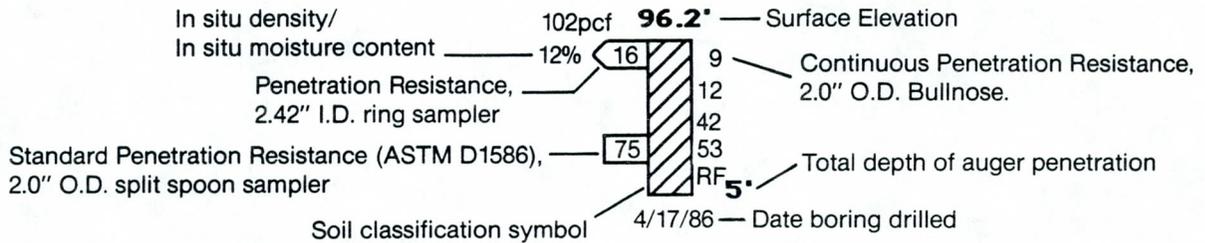
FINE-GRAINED SOIL

More than 50% smaller than 200 sieve size

SYMBOL	LETTER	DESCRIPTION	MAJOR DIVISIONS
	ML	INORGANIC SILTS, ROCK FLOUR, AND FINE SANDY OR CLAYEY SILTS OF LOW TO MEDIUM PLASTICITY	SILTS AND CLAYS Liquid limit less than 50
	CL	INORGANIC CLAYS, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, AND LEAN CLAYS OF LOW TO MEDIUM PLASTICITY	
	OL	ORGANIC SILTS AND ORGANIC SILT-CLAY MIXTURES OF LOW TO MEDIUM PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, AND FINE SANDY OR CLAYEY SILTS OF HIGH PLASTICITY	SILTS AND CLAYS Liquid limit greater than 50
	CH	INORGANIC CLAYS, FAT CLAYS, AND SILTY CLAYS OF HIGH PLASTICITY	
	OH	ORGANIC CLAYS AND ORGANIC SILTS OF MEDIUM TO HIGH PLASTICITY	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

LEGEND FOR GRAPHICAL BORING LOGS:

Log denotes visual approximation unless accompanied by mechanical analysis and Atterberg limits.



PENETRATION RESISTANCE: Blows per foot using 140 lb. hammer with 30" free-fall unless otherwise noted.

GRAIN SIZES							
U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENINGS			
200	40	10	4	3/4"	3"	12"	
SILTS & CLAYS DISTINGUISHED ON BASIS OF PLASTICITY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		
MOISTURE CONDITION (INCREASING MOISTURE →)							
DRY	SLIGHTLY DAMP	DAMP	MOIST	VERY MOIST	WET (SATURATED) (Liquid Limit)		
(Plastic Limit)							

CONSISTENCY CORRELATION		RELATIVE DENSITY CORRELATION	
CLAYS & SILTS	BLOWS/FOOT*	SANDS & GRAVELS	BLOWS/FOOT*
VERY SOFT	0-2	VERY LOOSE	0-4
SOFT	2-4	LOOSE	4-10
FIRM	4-8	MEDIUM DENSE	10-30
STIFF	8-16	DENSE	30-50
VERY STIFF	16-32	VERY DENSE	OVER 50
HARD	OVER 32		

*Number of blows of 140 lb. hammer falling 30" to drive a 2" O.D. (1-3/8" I.D.) split-spoon sampler (ASTM D1586).

Project No. 90-0145

THOMAS-HARTIG & ASSOCIATES, INC.

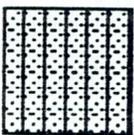
LEGEND OF SOIL TYPES



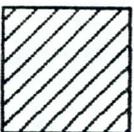
PROBABLE FILL, CLAYEY GRAYELLY SAND (SC); brown; fine to coarse sand size; angular; dense; low plasticity; slightly damp.



CLAYEY SAND & GRAYEL (SC & GC); brown to light brown; stratified; fine to coarse sand size; medium dense to dense; low plasticity; angular; scattered cobbles and boulders.



SILTY SAND (SM); brown; fine; medium dense; non-plastic; damp.



SILTY CLAY (CL); light brown to dark brown; very stiff; medium plasticity; blocky; vesicular.



BRECCIA FANGLOMERATE; white to grey; angular gravel- and cobble-size rock clasts cemented in a matrix of caliche-cemented angular sand; degree of cementation generally varies from moderate to heavy; with zones of concrete-like consistency.



SCHIST; grey; generally hard but with some soft zones; numerous joints and fractures.

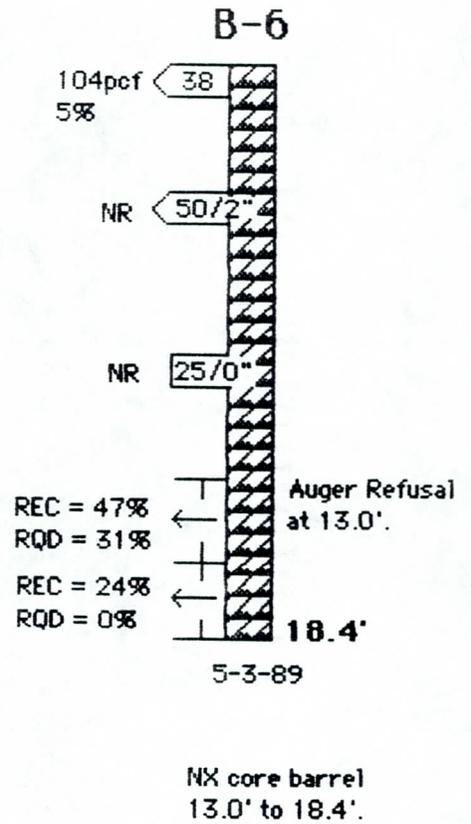
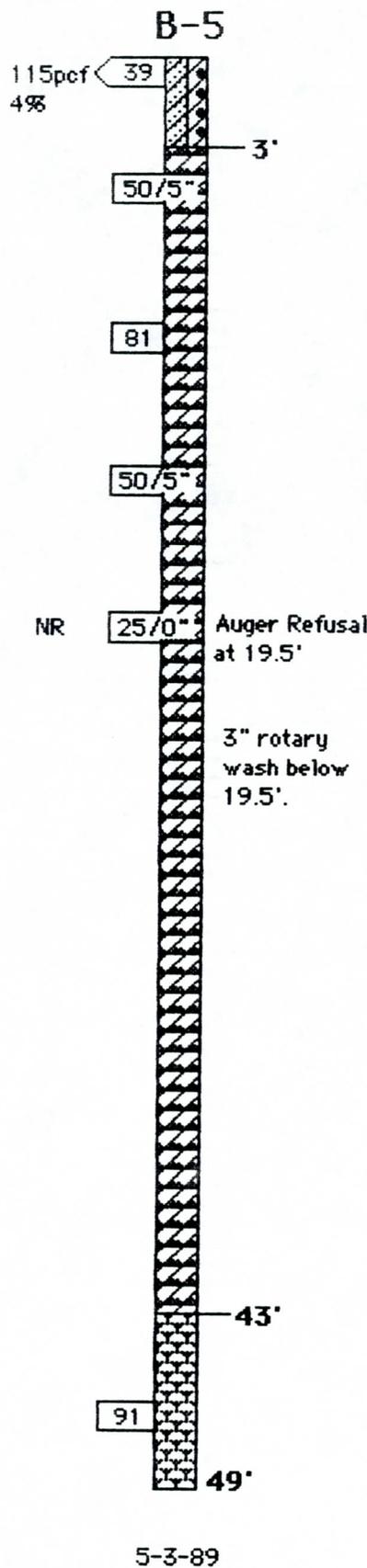
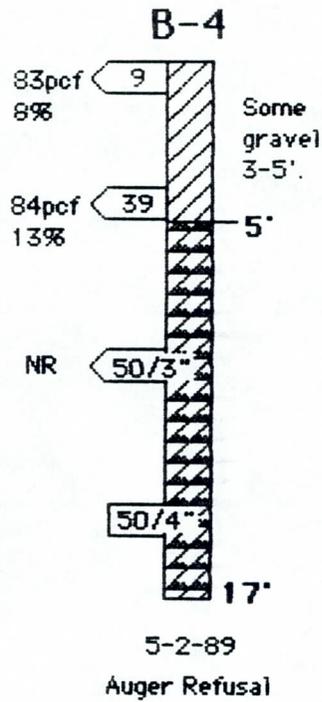
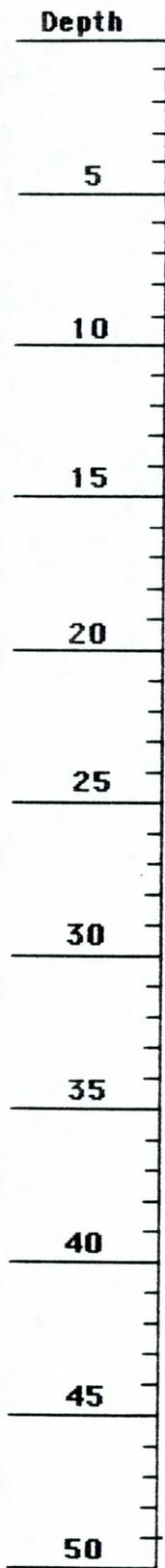
No free groundwater was encountered in any of the borings during drilling.

All borings drilled with 7" hollow stem augers unless otherwise noted.

**Project No. 89-0326
Thomas-Hartig & Associates, Inc.**

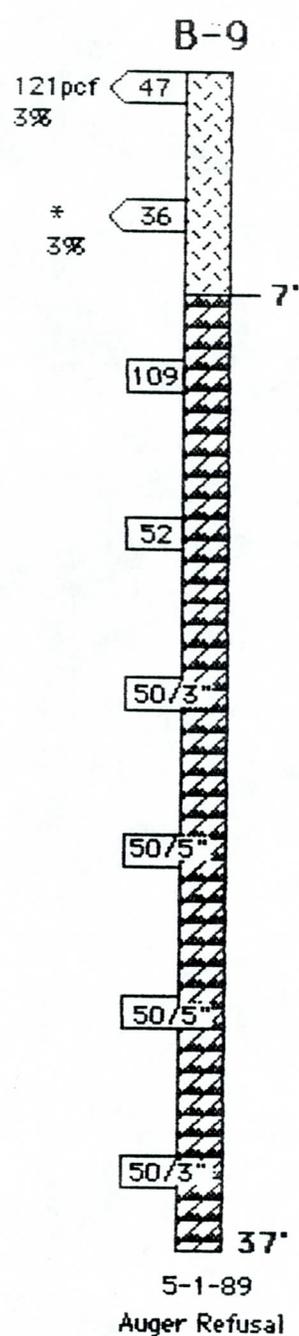
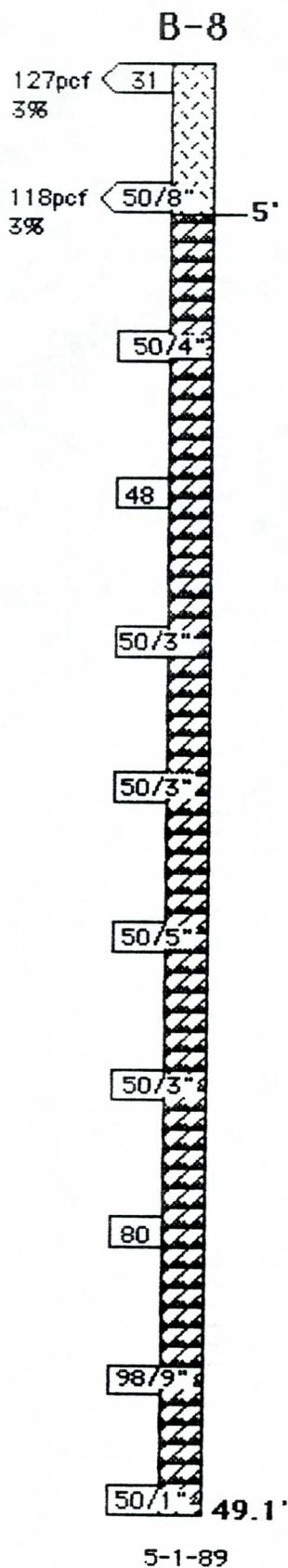
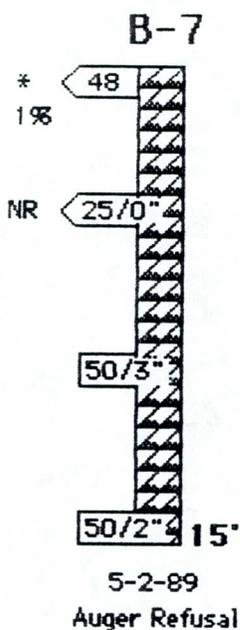
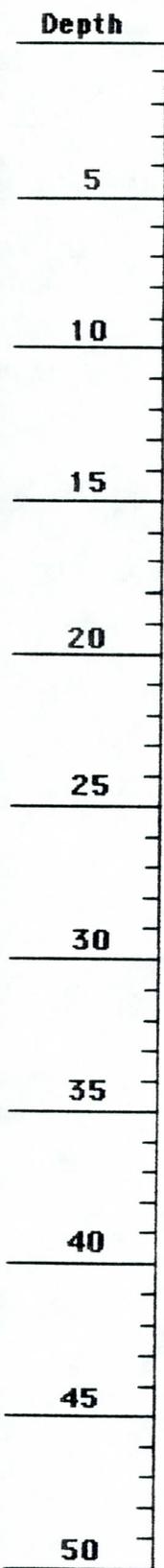
NOTE: The data presented on the boring logs represents subsurface conditions only at the specific locations and at the time designated. This data may not represent conditions at other locations and/or times. Contacts between soil strata are approximate and changes between soil types may be gradual rather than abrupt. This boring data was compiled primarily for design purposes and should not be construed as part of the plans governing construction or defining construction techniques. Bidders are fully responsible for interpretations or conclusions they draw from the boring log.

GRAPHICAL BORING LOGS



Project No. 89-0326
 Thomas - Hartig & Associates

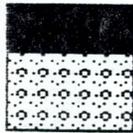
GRAPHICAL BORING LOGS



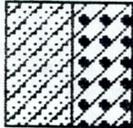
*Too disturbed to determine density.

Project No. 89-0326
Thomas - Hartig & Associates

LEGEND OF SOIL TYPES



ASPHALTIC CONCRETE OYER AGGREGATE BASE



CLAYEY SAND AND GRAVEL (SC&GC); brown to light brown; stratified; fine to coarse sand size; dense; generally low plasticity; angular; scattered cobble and boulder-sized fragments; intermittent light to moderate cementation.

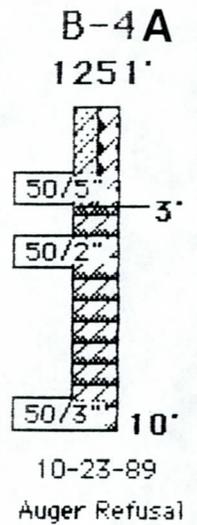
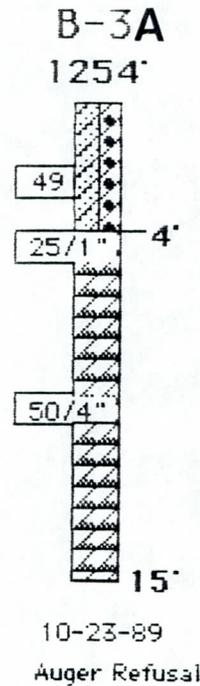
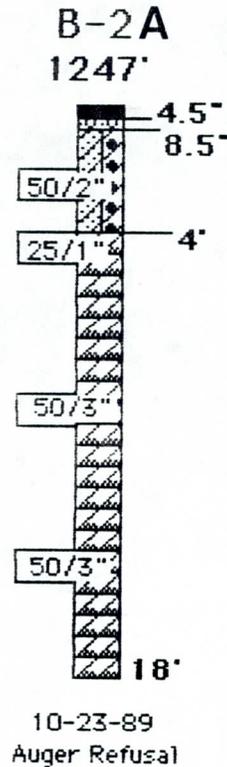
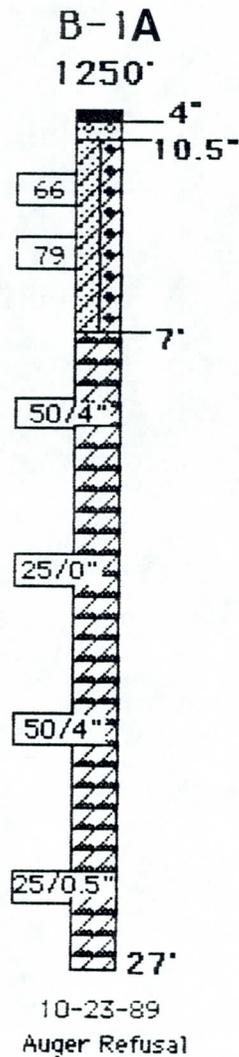
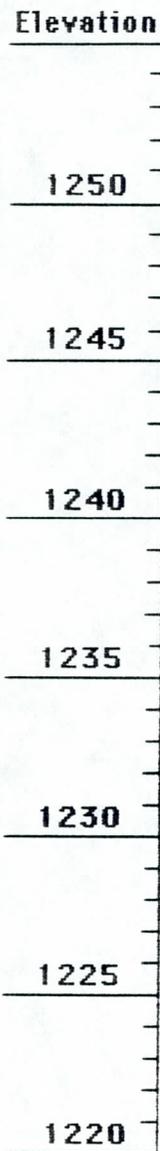


BRECCIA CONGLOMERATE; white to grey; stratified; angular gravel- and cobble-size rock clasts cemented in a matrix of caliche-cemented angular sand; degree of cementation generally varies from moderate to heavy; with zones of concrete-like consistency and zones of light cementation.

NOTE: Boring elevations are approximate, based on interpolation between contours shown on site survey.

Project No. 89-0872
Thomas-Hartig & Associates, Inc.

GRAPHICAL BORING LOGS



No free groundwater was encountered in any of the borings during drilling.

All borings drilled with 7" diameter hollow stem auger unless otherwise noted.

**Project No. 89-0872
Thomas - Hartig & Associates**

NOTE: The data presented on the boring logs represents subsurface conditions only at the specific locations and at the time designated. This data may not represent conditions at other locations and/or times. Contacts between soil strata are approximate and changes between soil types may be gradual rather than abrupt. This boring data was compiled primarily for design purposes and should not be construed as part of the plans governing construction or defining construction techniques. Bidders are fully responsible for interpretations or conclusions they draw from the boring log.

3.3 RESULTS OF THE SEISMIC SURVEY (continued)

Table 1 (continued)

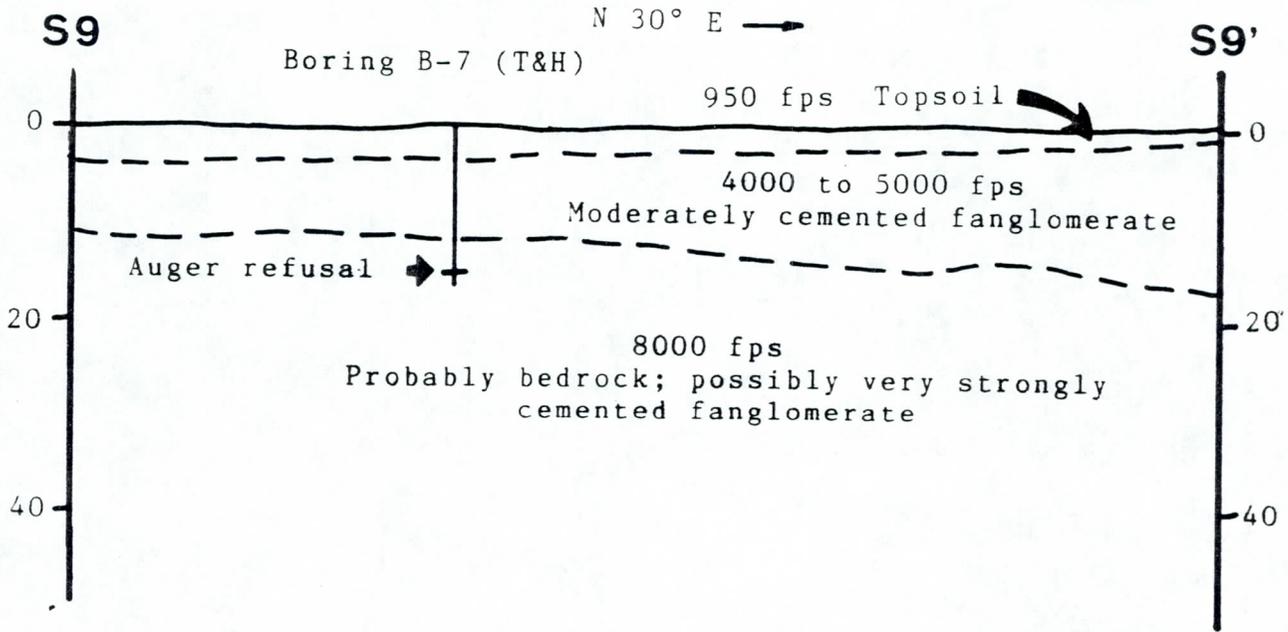
SEISMIC REFRACTION GEOPHYSICAL SURVEY
 DATA INTERPRETATIONS

(c) Discharge Line and 60" Water Main Relocation Alignments

Seismic Survey No.	S9		S10		S11		S12	
	F	R	F	R	F	R	F	R
V1 (fps)	950	950	1350	1350	1750	1000	1500	1025
Material	t	t	wfg	wfg	mfg	wfg	wfg	wfg
Depth to Base (ft)	4	1	9	9.5	6	2.5	8.5	6
V2 (ft)	4000	5000	4600	5200	3500	3500	5600	5500
Material	mfg	mfg	mfg	sfg	mfg	mfg	sfg	sfg
Depth to Base (ft)	9.5	16.9	29.7	--	32.4	19.1	43.9	45.4
V3 (fps)	8000	8000	6000	--	8000	5700	15000	15000
Material	sfg/rk	sfg/rk	sfg	--	rock	sfg	rock	rock

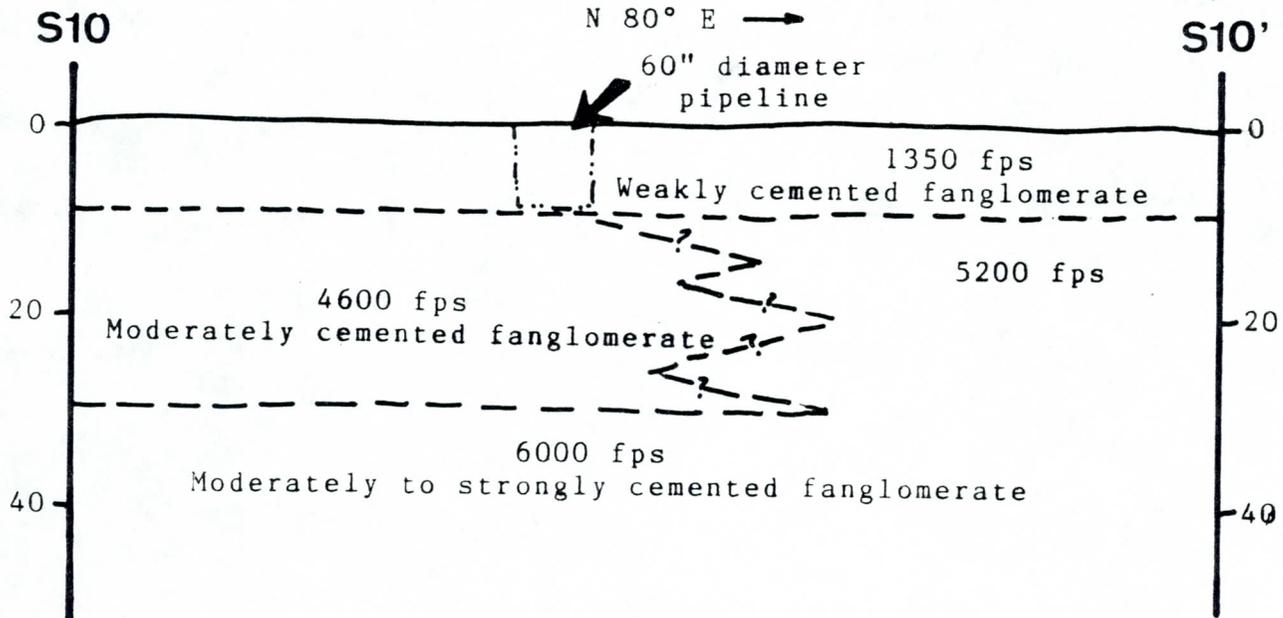
Seismic Velocity Interpretation / Material Correlation:

- t Topsoil (residual soil)
- t/f Topsoil/fill
- f/wfg Fill/weakly cemented fanglomerate
- wfg Weakly cemented fanglomerate
- mfg Moderately cemented fanglomerate
- sfg Strongly cemented fanglomerate
- sfg/rk Strongly cemented fanglomerate (?) (possibly rock)
- rock Bedrock (probably schist; possibly quartzite)



SRP Switchyard structure(s)
parallel to survey line

High capacity pumps off
end of survey line



Note: Accuracy of velocity interpretations may be
influenced by equipment noise levels and structures.